The Journal of the Iowa Academy of Science: JIAS

Volume 105 | Number Article 6

1998

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James J. Dinsmore
Iowa State University

Jour. Iowa Acad. Sci. 105(3):115–122, 1998

Iowa's Avifauna: Recent Changes and Prospects for the Future

JAMES J. DINSMORE

Department of Animal Ecology, Iowa State University, Ames, IA 50011

Iowa's avifauna has changed dramatically since 1980. The state list now has 40 additional species and totals 398 species, the most of any vertebrate group. Four species that had not previously nested in Iowa (Ring-billed Gull, Great-tailed Grackle, House Finch, Eurasian Tree Sparrow) and four whose nesting populations had disappeared (Double-crested Cormorant, Sandhill Crane, Piping Plover, Least Tern) now breed regularly here. Little Blue Heron, Cattle Egret, White-faced Ibis, Mississippi Kite, Prairie Warbler, and Red Crossbill nested for the first time but do not have established nesting populations. Trumpeter Swan, Peregrine Falcon, Greater Prairie-Chicken, and Sharp-tailed Grouse have been reintroduced to Iowa but nesting populations are not well established. The nesting distributions of Canada Goose, Bald Eagle, Wild Turkey, and Gray Partridge have changed greatly since 1980. Despite these gains in Iowa's avian diversity, one nesting species (Say's Phobe) has disappeared from Iowa since 1980. Thirteen species are listed as endangered, threatened, or of special concern, and 36 other species have nesting populations of fewer than 1,000 pairs. The survival of some of those 49 species is in jeopardy. Another 16 species, although still relatively common, have shown long-term population declines in Iowa and in North America and may be in jeopardy. Iowa's avifauna is dynamic, and changes can be expected to continue in the future as some species thrive, new species colonize the state, and others decline or disappear.

INDEX DESCRIPTORS: birds, endangered species, population changes, population declines, range changes, introduced species

Our knowledge of Iowa's birds dates to the early 1800s when Lewis and Clark mentioned several species they found along the Missouri River (Moulton 1986). This knowledge grew fairly rapidly in the late 1800s, culminating with the first comprehensive treatment of Iowa's birds covering 354 species (Anderson 1907). The formation of the Iowa Ornithologists' Union in 1923 and the initiation of its quarterly journal, *Iowa Bird Life,* in 1931 provided a forum for the study of Iowa's birds. DuMont's monograph on Iowa's birds, based largely on specimens, listed 364 species (DuMont 1933). For the next 50 years, there was considerable ornithological activity in the state and several fairly detailed lists of Iowa's birds (e.g., Brown 1971) were published. In 1980, I discussed the status of Iowa's birds and appended to that paper a list of 380 species reported from the state (Dinsmore 1981).

The goal of this paper is to review the status of Iowa's birds, especially those that nest in the state, with emphasis on what has happened since 1980, and to speculate on Iowa's avifauna of the future. Topics covered include changes in the state list, additions and losses of breeding species, breeding species range changes, species introductions and reintroductions, species with small breeding populations, and species with decreasing populations in the state.

METHODS

Since 1980, there has been a tremendous amount of work on Iowa's birds. The major sources of information are: a) hundreds of observations by birders and scientists from throughout Iowa, many of which were published in the the Field Reports section of *Iowa Bird Life* and have been summarized in two books (Dinsmore et al. 1984, Kent and Dinsmore 1996); b) data on the distribution of Iowa's breeding birds collected during the Iowa Breeding Bird Atlas project (Jackson et al. 1996); c) systematic surveys of several species (e.g., Andrews et al. 1995); and d) data on long-term population trends of many Iowa species based on 34 Breeding Bird Survey (BBS) routes surveyed yearly in Iowa since 1967 (Sauer et al. 1996). These publications and data bases have been the source of most of the information in this paper.

I have focused my attention on the 198 species that have been reported nesting in Iowa (Kent 1996). Some of these species no longer nest in Iowa, and others nest here only occasionally. I have based some of my analysis on a list of 150 species that, in my judgement, nest in Iowa nearly every year. This list is similar to the list of 144 species considered by Best et al. (1995) with a few adjustments. Nine species (Double-crested Cormorant, Northern Harrier, Common Moorhen, Piping Plover, Forster's Tern, Least Tern, Barn Owl, Chestnut-sided Warbler, and Great-tailed Grackle) are added, four species (Green-winged Teal, Gadwall, Ring-necked Duck, Least Flycatcher) are deleted, and the two meadowlark species, which were combined in that paper, are considered separately here. These modifications reflect recent changes in nesting status of several species and the addition of several very rare species that were not considered by Best et al. (1995). Scientific names for all species mentioned in the text are listed in Appendix A.

RESULTS

The State List

Although birds are probably the most noticed and perhaps the best studied vertebrate group in the state, the number of bird species known to occur in Iowa has continued to grow throughout this century. Shortly after the status of Iowa's avifauna was reviewed in a 1980 symposium (Dinsmore 1981), many reports of Iowa birds were critically reevaluated by the Records Committee of the Iowa Ornithologists' Union. As a result of that review, the list of birds known from Iowa in 1980 was reduced to 361 species (Kent et al. 1982) and several decisions since then have reduced the list even more. However, since 1980, 40 species have been added to the state list, bringing the total as of the end of 1996 to 398 species (Kent and

Dinsmore 1996). Thus the birds alone comprise 60% of all the recent vertebrate species known from Iowa.

Nesting Status Changes

Since 1980, the nesting status of a number of Iowa species has changed. These fall into the following categories:

a). Species that had not nested previously in Iowa and have established nesting populations (= nest yearly):

Great-tailed Grackle: This southwestern species was first found in Iowa in 1983 when it nested in Fremont County (Silcock 1983). Since then, it has nested in at least 12 counties in western and central Iowa (Dinsmore and Dinsmore 1993, Kent and Dinsmore 1996).

House Finch: This western species was accidentally released in New York in 1940 and since then has expanded its range westward (Elliott and Arbib 1953, Cecil and Dinsmore 1995). First reported in Iowa in 1982, House Finches spread rapidly across the state. Nesting was first noted in Wayne and Scott counties in 1986 (Dinsmore and Petersen 1986) and, by 1991, it was found throughout Iowa (Cecil and Dinsmore 1995).

Eurasian Tree Sparrow: This Old World species was introduced in St. Louis in 1870 and was first reported in Iowa in 1987 (Veal 1987). It now occupies a limited range along the Mississippi River north to about Muscatine. It was reported nesting near Burlington in 1993 and probably nests in most of its Iowa range (Kent and Dinsmore 1996).

Ring-billed Gull: This common migrant was found nesting near Spirit Lake in Dickinson County in 1994 (Waltz 1994) and has nested there yearly since then. Ring-billed Gull nesting populations in northeastern South Dakota have increased in recent years (Peterson 1995), and its expansion into Iowa was expected.

b). Species that previously nested in Iowa, were extirpated, and have reestablished breeding populations:

Piping Plover: This small plover formerly nested on sandbars along the Missouri River near Sioux City and Council Bluffs. The last Iowa population at De Soto National Wildlife Refuge in Harrison County disappeared about 1973. Piping Plovers were found nesting on fly-ash deposits at power plants near Council Bluffs in 1983 (Wilson et al. 1983) and near Sioux City in 1985 (Williams 1985) and have nested at one or both of those sites yearly since then.

Least Tern: Like the Piping Plover, this small tern nested on sandbars along the Missouri River. The last known Iowa population at De Soto National Wildlife Refuge disappeared about 1973. Least Terns nested on fly-ash deposits at a power plant near Council Bluffs in 1984 and have nested there and at a similar site near Sioux City nearly every year since then (Dinsmore et al. 1993, Huser 1996).

Double-crested Cormorant: Although cormorants once nested in Iowa, in 1980 there were no established colonies in the state. In 1984 small colonies were found at Coralville Reservoir in Johnson County and on the Mississippi River near Sabula in Jackson County. The number nesting on the Mississippi River has increased greatly and, in 1996, several colonies near Clinton contained about 300 nests and a colony near Harpers Ferry in Allamakee County had 364 nests (M. Griffin, pers. comm.).

Sandhill Crane: Once a fairly common nesting species in northern Iowa, the last nest reported was in Hancock County in 1894 (Anderson 1894). Recently, the number of Sandhill Cranes nesting in Wisconsin increased greatly and it was anticipated that eventually cranes would return to Iowa. In 1992, two pairs nested at Otter Creek Marsh in Tama County (Poggensee 1992). Since then, they have nested at several sites in eastern Iowa (Kent and Dinsmore 1996).

c). Species that were not previously known to nest in Iowa and nested here since 1980 but do not have an established nesting population:

Red Crossbill: This nomadic species was reported nesting in Des Moines in 1982 and 1986 (Kent and Dinsmore 1996).

Cattle Egret: This Old World species has undergone a tremendous range expansion in this century (Telfair 1983). There are three reports of nesting for Iowa: Mills County in 1984 (Silcock 1984), near Marshalltown in 1993, and in Monona County in 1993 (Kent and Dinsmore 1996).

Little Blue Heron: At least one pair of this southern species nested with Cattle Egrets in Mills County in 1984 (Silcock 1984).

White-faced Ibis: This western species is a rare migrant in Iowa. In 1986, three nests were found near Spirit Lake in Dickinson County (Dinsmore and Dinsmore 1986).

Mississippi Kite: In 1991, two adults of this southern species summered in the Des Moines area. Kites were seen there for the next several years and nesting was suspected but was not confirmed until 1995 when a nest was found in Windsor Heights (Walsh 1996). Another nest was found in Ledges State Park in Boone County in 1997.

Prairie Warbler: This eastern warbler nested near Iowa City in 1995 (Edwards 1995). Two males were at the same site in 1996 and 1997 but nesting was not confirmed.

d). Species that have been reintroduced to the state. All these species were native to Iowa but their nesting populations had been extirpated. Although three of these species have nested successfully in Iowa as a result of these reintroductions, it is unclear whether viable populations have been reestablished.

Greater Prairie-Chicken: Once abundant throughout Iowa, the last nesting population disappeared from Appanoose County in the mid 1950s (Stempel and Rodgers 1961). Greater Prairie-Chickens were released in Monona County in 1980 and 1982, in Ringgold County from 1987 to 1994, and in Adair County in 1993 and 1994 (Andrews et al. 1995). They have nested successfully in Ringgold County.

Peregrine Falcon: Prior to the widespread use of DDT, a few peregrines nested on bluffs along the Mississippi and other Iowa rivers. The last nest was found in 1967 (Roosa and Stravers 1989). Peregrines were released in Cedar Rapids, Des Moines, Muscatine, Iowa City and Mason City from 1989 to 1996 (Andrews et al. 1995, Kent and Dinsmore 1996). As a result of those releases, peregrines have nested in Des Moines and Cedar Rapids for several years.

Sharp-tailed Grouse: Originally found in northwestern Iowa, nesting Sharp-tailed Grouse probably disappeared from Iowa by the early 1900s. A few were released in Monona County in 1990 and 1995 but to date there is no evidence of sustained breeding by these birds (Weiner 1995).

Trumpeter Swan: Prior to settlement, Trumpeter Swans nested in northern Iowa. The last nesting report in Iowa was in Hancock County in 1883 (Anderson 1907). A program to restock Trumpeter Swans in Iowa was started in 1994 (Andrews 1995). Through 1996, 49 swans have been released throughout the state. These birds still receive some care from humans and have nested at several sites.

Nesting Range Changes

The distributions of most bird species change constantly, usually in very minor ways. In addition to the eight nesting species that colonized or recolonized Iowa (see above), several other species have shown dramatic changes in their nesting ranges in Iowa since 1980.

Canada Goose: Once a common nesting species in northern Iowa,

Table 1. Endangered, threatened, and special concern species in Iowa and estimated population levels.

SPECIES	[a]ESTIMATED POPULATION	[b]CONFIDENCE IN ESTIMATE
Endangered Species		
Bald Eagle	2	2
Red-shouldered Hawk	2	2
Northern Harrier	2 (1?)	1
Peregrine Falcon	1	2
King Rail	2 (1?)	1
Piping Plover	1	2
Least Tern	1	2
Barn Owl	1 (2?)	1
Short-eared Owl	1	1
Threatened Species		
Long-eared Owl	1 (2?)	1
Henslow's Sparrow	3	2
Special Concern Species		
Forster's Tern	2	1
Black Tern	2 (3?)	1

[a]Population estimate: 1 = <10 pairs; 2 = 10–100 pairs; 3 = >100–1,000 pairs

[b]Level of confidence: 1 = educated guess; 2 = Some population information available and probably fairly accurate estimate

Canada Geese disappeared about 1900. Canada Geese were reintroduced to Iowa in 1967. Since then, the Iowa Department of Natural Resources has released geese at sites throughout Iowa. They have become established at most of those sites, have expanded into nearby habitat, and now are found statewide (Andrews et al. 1995).

Bald Eagle: Bald Eagles nested in Iowa at the time of European settlement but disappeared around 1900. The first nest reported in Iowa in recent times was in 1977 in Allamakee County (Roosa and Stravers 1989). Although most nests have been near the Mississippi River in northeastern Iowa, Bald Eagles have nested on several other rivers including a few nests in northwestern Iowa (B. Ehresman, pers. comm., Kent and Dinsmore 1996).

Wild Turkey: Wild Turkeys were native to Iowa and disappeared about 1900. They were successfully restocked in Iowa, first at Shimek (1966) and later at Stephens State Forest (1968) in southern Iowa and eventually throughout Iowa. Since 1980, there have been additional releases and now turkeys are established throughout Iowa (Andrews et al. 1995).

Gray Partridge: This introduced species has shown a dramatic change in its nesting distribution since 1980. For many years it was mainly confined to northwestern Iowa. In the early and mid 1980s, it underwent a rapid range expansion and, by the late 1980s, was found statewide except in extreme northeastern Iowa. In the early 1990s, the population declined abruptly; currently Gray Partridge are found mainly in north-central and northwestern Iowa.

Nesting Species Lost

To my knowledge, only one nesting species seems to have disappeared from Iowa since 1980. A few pairs of the Say's Phoebe, a Great Plains flycatcher, nested most years from 1960 to 1983 near the Big Sioux River in northwestern Iowa (Bryant 1969, 1977, Kent and Dinsmore 1996). Those birds had disappeared by the mid 1980s and, at present, none are known to nest in Iowa.

Endangered, Threatened, and Special Concern Species

The Iowa Department of Natural Resources lists nine bird species as Endangered, two as Threatened, and two of Special Concern (State of Iowa 1994). In Table 1 I have estimated the size of the breeding population for each these species. Note that we have population data for only 6 of the 13. For the other 7, the estimate is an educated guess, based on the species' known distribution, habitat needs, and number of recent nesting reports. In terms of populations of these species, I believe that for 6 of these 13 species, fewer than 10 pairs nest in Iowa annually and, for 6 others, the breeding population is probably between 10 and 100 pairs. Only the Henslow's Sparrow probably has a breeding population in excess of 100 pairs.

a). Endangered species: These are species for which there is concern about their future survival in the state.

Bald Eagle: Bald Eagles are doing well in Iowa. For a number of years, only a few pairs of eagles nested and as recently as 1990, only seven nests were known in the state. Since then, the number of nests has increased rapidly and, in 1997, there were 58 active nests in 22 counties (B. Ehresman, pers comm.).

Northern Harrier: A few harriers probably nest in Iowa every year, most likely on grasslands in south-central and northwestern parts of the state. A survey of some potential habitat in northwestern Iowa in 1993 located only one confirmed and two probable nests (Hemesath 1993).

Red-shouldered Hawk: A small nesting population persists near the Mississippi River, mainly in northeastern Iowa. In 1993, 21 nest sites were known (Stravers and McKay 1993) and there are probably a few pairs elsewhere in the state.

Peregrine Falcon: As a result of the Iowa Department of Natural Resources' program to reintroduce Peregrine Falcons to Iowa, peregrines have nested successfully in Cedar Rapids and Des Moines and unsuccessfully in Davenport. However, there is no evidence of peregrines nesting outside these urban areas.

King Rail: All three reports of King Rails nesting in Iowa since 1980 were from near the Mississippi River (Kent and Dinsmore 1996). Probably only a few pairs of this secretive species nest in Iowa each year.

Piping Plover: The nesting populations at Council Bluffs and Sioux City have persisted for more than a decade but they are so small that their long-term survival is still precarious. Usually these populations total fewer than 10 pairs.

Least Tern: The nesting populations at Council Bluffs and Sioux City have shown considerable year-to-year variation. As many as 14 pairs have nested at Council Bluffs (1986) but in recent years, only a few birds have been found there. There were five nests at Sioux City in 1995 (Huser 1996) and seven in 1996 and 1997. Like the Piping Plover, its long-term survival in Iowa is questionable.

Barn Owl: From 1983 to 1987, the Iowa Department of Natural Resources released 427 Barn Owls in Iowa. Despite widespread publicity, there is no evidence that any of the released owls nested successfully (Ehresman et al. 1988). In most years, a few Barn Owl nests are reported in Iowa but there is great year-to-year variation (seven in 1995, none in 1996, one in 1997).

Short-eared Owl: There are only a few confirmed nesting records since 1981, most recently in Kossuth County in 1995. None were found during an intensive search in northwestern Iowa in 1993 (Hemesath 1993).

Table 2. Species other than state-listed species that have small nesting populations in Iowa.

SPECIES	[a]ESTIMATED POPULATION	[b]CONFIDENCE IN ESTIMATE
Double-crested Cormorant	3	2
American Bittern	2 (1?)	1
Great Egret	3	2
Black-crowned Night-Heron	2	1
Yellow-crowned Night-Heron	2 (1?)	1
Northern Pintail	2 (1?)	1
Northern Shoveler	2	1
Redhead	2	1
Hooded Merganser	3	1
Ruddy Duck	2 (1?)	1
Cooper's Hawk	2	1
Broad-winged Hawk	2 (3?)	1
Swainson's Hawk	2	1
Common Moorhen	2 (3?)	1
American Coot	3	1
Sandhill Crane	1	2
Ring-billed Gull	2	2
Chuck-will's-widow	2 (3?)	1
Yellow-bellied Sapsucker	3	1
Western Kingbird	3	1
Brown Creeper	2 (3?)	1
Carolina Wren	3 (2?)	1
Bewick's Wren	1	1
Veery	3 (2?)	1
Northern Mockingbird	3 (2?)	1
White-eyed Vireo	3 (2?)	1
Blue-winged Warbler	3	1
Northern Parula	3	1
Chestnut-sided Warbler	1 (2?)	1
Yellow-throated Warbler	3 (2?)	1
Cerulean Warbler	3	1
Worm-eating Warbler	2 (3?)	1
Louisiana Waterthrush	3	1
Yellow-breasted Chat	2 (3?)	1
Summer Tanager	3 (2?)	1
Great-tailed Grackle	3	1

[a]Population estimate: 1 = <10 pairs; 2 = 10–100 pairs; 3 = >100–1,000 pairs

[b]Level of confidence: 1 = educated guess; 2 = Some population information available and probably fairly accurate estimate

b). Threatened species: These are species for which there is concern that they may someday become endangered.

Long-eared Owl: A few Long-eared Owls probably nest in Iowa yearly but because of their secretive nature, few nests are reported. The most recent nest was reported in Clarke County in 1988.

Henslow's Sparrow: A few populations of this secretive grassland species persist in southeastern Iowa (Van Buren and Davis counties, Melde and Koford 1996) and south-central Iowa (especially Ringgold and Decatur counties, P. Melde, pers. comm.) and perhaps elsewhere.

c). Special concern species: These are species that may warrant future consideration as endangered or threatened species.

Forster's Tern: Through the early 1980s, a few small colonies of Forster's Terns were active in northern Iowa. Since then, this species has been more unpredictable and, in most years, only a few pairs nest in Iowa.

Black Tern: Through the early 1980s, Black Terns nested on a number of wetlands in the Great Lakes region. Since then, they have become much less common and presently only a few pairs nest in Iowa most years.

Table 3. Species that, based on 1966–96 Breeding Bird Survey data, have shown significant ($P < 0.05$) population increases both in Iowa and in North America. See Geissler and Sauer (1990) for methods. Data are for 1967–96 for Iowa and 1966–96 for North America.

	AVERAGE ANNUAL INCREASE (%)	
	IN IOWA	IN NORTH AMERICA
Great Blue Heron	16.7	2.1
Wood Duck	11.3	7.1
Mallard	7.4	2.0
Cliff Swallow	14.1	1.4
House Wren	1.9	1.4
American Robin	2.0	0.8

Other Species with Small Populations

In addition to the 13 species that have received special recognition by the state, in my judgement, 36 other species that breed in Iowa virtually every year have breeding populations of fewer than 1,000 pairs (Table 2). Of these 36 species, I believe that 3 have breeding populations in Iowa of fewer than 10 pairs, 16 have breeding populations of between 10 and 100 pairs, and 17 have breeding populations of from 100 to 1,000 pairs (Table 2).

Long-Term Population Changes of Fairly Common Species

In addition to the above species that currently have small breeding populations in Iowa, a number of species that currently have relatively large breeding populations have shown long-term population declines in Iowa. According to Iowa BBS data for 150 bird species that nest in Iowa yearly (see Methods), 19 species are showing population declines, 11 are increasing, 45 have populations that seem to be stable, and, for 75, we do not have enough data to analyze population trends in Iowa (Sauer et al. 1996).

I also looked at population trends of these 150 species based on BBS data at the continental level. Perhaps of most interest are the six species that show population increases both in Iowa and North America (Table 3) and the 16 species that show population declines at both levels (Table 4). The six that show population increases at both levels are a mixed group but three (Great Blue Heron, Wood Duck, Mallard) are wetland species and a fourth (Cliff Swallow) typically nests on bridges and other structures associated with wetlands.

The fact that 16 species are showing long-term population declines both in Iowa and in North America is of some concern. These are all species that are still relatively common and are encountered frequently enough on BBS routes in Iowa to have data to analyze population trends within the state. For all of these species, Iowa historically has supported a substantial population. Only the Northern Bobwhite could be considered a species that is on the edge of its range in Iowa and even for it, Iowa has historically had a healthy population in the southern half of the state. Thus long-term population declines by these species both in Iowa and in North America suggest that their populations may be in trouble.

Table 4. Species that, based on Breeding Bird Survey data, have shown significant ($P < 0.05$) population declines both in Iowa and in North America. See Geissler and Sauer (1990) for methods. Data are for 1967–96 for Iowa and 1966–96 for North America.

	AVERAGE ANNUAL DECLINE (%)	
	IN IOWA	IN NORTH AMERICA
Ring-necked Pheasant	2.0	1.0
Northern Bobwhite	3.6	2.5
Mourning Dove	1.2	0.3
Red-headed Woodpecker	4.1	2.2
Northern Flicker	5.4	2.8
Eastern Kingbird	2.8	0.7
Horned Lark	4.0	1.3
Blue Jay	3.9	1.5
Brown Thrasher	2.4	1.2
Loggerhead Shrike	9.1	3.6
Common Yellowthroat	1.5	0.3
Dickcissel	3.6	1.6
Bobolink	4.8	1.6
Red-winged Blackbird	1.0	1.0
American Goldfinch	4.9	0.8
House Sparrow	1.1	2.2

Although the 16 species that are showing population declines both in Iowa and in North America are a mixed group of species, a few patterns stand out. First there are no strictly woodland species on that list. This is mainly because the BBS routes in Iowa do a poor job of sampling woodland species, and thus most of these species fall in the "not enough data" category. Secondly, only the Red-winged Blackbird could be considered a wetland species but in Iowa it is commonly found along roadsides and in grasslands rather than strictly in wetlands. Thirdly, a number of these 16 species are typically found either on grasslands and agricultural fields (Ring-necked Pheasant, Horned Lark, Dickcissel, Bobolink) or in grassy areas with some mixed shrubs or trees (Northern Bobwhite, Red-headed Woodpecker, Eastern Kingbird, Loggerhead Shrike). Despite the abundance of such habitats in Iowa, species associated with those habitats may be encountering some serious problems. Recent changes in haying practices prevent several grassland species from having sufficient time to raise a brood while the loss of fencerows and shrubs has had an adverse effect on farmland edge species (Frawley and Best 1991, Koford and Best 1996).

DISCUSSION

The Future of Iowa's Avifauna

So, what does the future hold for Iowa's avifauna? Certainly, a key word is change. Just as there has been considerable change in the recent past, Iowa's avifauna will continue to change in the future. I believe that the following are areas where we can expect those changes.

The State List: It is safe to assume that the list of birds known to occur in Iowa will continue to grow, although perhaps not at the rate shown in recent decades. Two new species, White-winged Dove and Eurasian Collared-Dove, have been reported in 1997 (Kent 1997, Kent, pers. comm.) and more can be expected in the future. Most of these additions will be accidental species and will have negligible impact on the overall avifauna of the state. A comprehensive list of potential additions to the state's list is available elsewhere (Kent and Dinsmore 1996).

New Nesting Species: It is also likely that additional species will establish nesting populations in Iowa. One of the more likely candidates for this is the Mississippi Kite which has already nested in the Des Moines region (Walsh 1996) and at Ledges State Park. It has been undergoing a range expansion elsewhere, especially on the Great Plains (Parker and Ogden 1979), and expansion into Iowa seems likely.

Another possible new nesting species is the Osprey, a fairly common migrant in Iowa. Currently, Ospreys nest in central Wisconsin not far from northeastern Iowa. There appears to be suitable Osprey nesting habitat in Iowa along the Mississippi River and at several of the large reservoirs. A relatively modest range expansion would put it in Iowa. In summer 1997, the Macbride Raptor project and the Iowa Department of Natural Resources released four Ospreys at Coralville Reservoir in Johnson County in an attempt to start a nesting population there.

The American White Pelican, an increasingly common migrant in Iowa, is another potential nesting species. It commonly summers in Iowa, especially in the Great Lakes region, and has nested in southern Minnesota about 35 miles north of the Iowa border (Fall and Hiemenz 1994). It would not be surprising for it to nest in Iowa.

I also think that it is likely that at least one of the four species currently being reintroduced into Iowa (Trumpeter Swan, Peregrine Falcon, Greater Prairie-Chicken, Sharp-tailed Grouse) will become established in Iowa and perhaps several of these will be well established in a decade or two. Greater Prairie-Chickens already are nesting in the wild, and both Trumpeter Swans and Peregrine Falcons have nested with human assistance, a hopeful sign of establishing breeding populations in the state.

Range Expansions of Current Nesting Species: It seems likely that the nesting distribution of some current Iowa species will also change. Several species that have recently begun nesting in Iowa, including the Double-crested Cormorant, Bald Eagle, Sandhill Crane, Ring-billed Gull, Great-tailed Grackle, and Eurasian Tree Sparrow, are all likely to continue to expand their nesting range in the state.

Several well-established species have also shown gradual expansion of their breeding distribution in Iowa. Two examples are the Turkey Vulture which seems to be slowly expanding across the agricultural sections of central and north-central Iowa and the Northern Cardinal which seems to be slowly extending its range into northwestern Iowa. Other similar changes can be expected.

Species Losses: At the other extreme, it is likely that several species will disappear from the state. Among the species currently listed by the state as endangered, threatened, or of special concern, the future of the King Rail, Piping Plover, Least Tern, Barn Owl, Short-eared Owl, and Long-eared Owl is already precarious in Iowa. Likewise, both Forster's Tern and Black Tern populations seem to have declined since 1980 and now they nest only at a few sites.

Besides the state-listed species, several species listed in Table 2 also seem to have very small populations in Iowa. One of the most threatened of these is the Cerulean Warbler for which severe habitat loss on the wintering grounds is a serious concern (Robbins et al. 1992). Another woodland species which also seems to have declined with little notice in recent years is the Veery. Forest fragmentation, a problem for it in Illinois (Herkert 1995), may also be a problem in Iowa. The Bewick's Wren has long been rare in Iowa with only a few reports of nesting, most recently in Iowa County in 1995 (Jackson et al. 1996). This species has been declining throughout

eastern North America, perhaps because of competition with House Wrens (Kennedy and White 1996).

Thus, combining the species in Tables 1 and 2, there are 49 species of birds that regularly nest in Iowa and that have breeding populations of fewer than 1,000 pairs. Alarmingly, this is about a third of the species that regularly nest in Iowa. For a number of these (e.g., White-eyed Vireo, Worm-eating Warbler, Summer Tanager), their range just barely extends into Iowa and thus Iowa is peripheral to their main breeding populations. To lose such species from Iowa would be a loss to our overall breeding diversity but probably would have little effect on the overall survival of the species itself. Not all of those 49 are doing poorly in Iowa. Some currently seem to be doing well in the state, either as long-time established species (e.g., Western Kingbird) or as newly established species (e.g., Great-tailed Grackle). Others have a limited distribution but are doing well without any obvious threat to their habitat (e.g., Yellow-bellied Sapsucker, Brown Creeper). Still it is alarming that about a third of Iowa's regular breeding species have such small breeding populations in the state.

Population Declines: With the growing concern about biodiversity, many people may lose sight of another serious problem, namely long-term population declines by species that are still fairly common. Of the 16 species that have shown significant declines both in Iowa and in North America (Table 4), some are fairly common or even abundant and widespread in Iowa (e.g., Mourning Dove, Red-winged Blackbird, House Sparrow) and thus declines by them are probably of little significance. However, continuing declines by species like Red-headed Woodpecker, Dickcissel, and Bobolink may be more serious since Iowa is in the heart of the breeding ranges of these species. Put another way, if these species cannot maintain their populations in Iowa, then perhaps their overall long-term survival possibilities are bleak. Although it seems difficult to believe that these species will disappear entirely from Iowa, the documented population declines suggest that they may become rare within the state in the foreseeable future. One has only to recall that in 1900, Greater Prairie-Chicken, Upland Sandpiper, and Northern Harrier were all considered common nesting species in Iowa. Given the current status of these three species in Iowa, it is apparent that change can occur fairly rapidly.

What I am suggesting is that we should be vigilant in watching for danger signs among the species that now occur in Iowa and that our vigilance should not be confined just to rare species. The status of species that are common now can change, and we must be concerned about those changes as well.

Another concern is our inability to monitor the populations of many of Iowa's breeding species. Even though we have been monitoring breeding bird populations with the Breeding Bird Survey for 30 years, half (75 of 150) of the typical breeding species of Iowa are not being monitored adequately to analyze population trends within the state. For most of these species, this is because the species is uncommon or rare in Iowa, because its habitat is poorly sampled by the BBS routes in Iowa, or because it is nocturnal and thus poorly sampled by the BBS methodology. Whatever the reason, it is disturbing to know that for half of our breeding species, we simply do not have enough quantitative data to tell us what is happening in Iowa. This is especially true for aquatic and woodland species but it also applies to a number of species found in other habitats. In some cases, more years of monitoring may provide enough data to see what the trends are but for many species, probably the only solution is to increase the number of BBS routes in Iowa or to devise special surveys for individual species or groups of species. This lack of population data of any form is also apparent for species with small populations. We have some population data for only 6 of the 13 listed species (Table 1) and 4 of 36 other species with small populations (Table 2).

Iowa's Avifauna of the Future: So, what will Iowa's avifauna be like in say 2025? Short of some unforeseen catastrophic events, Iowa will still support a varied avifauna composed mostly of species that are present and thriving today. There will certainly be some changes, though, and those changes will be a function of at least two major factors: the adaptability of the individual species and the continued availability of a variety of habitats. As Iowa's landscapes become increasingly affected by humans, species that can adapt to those changes will be "winners" and those that cannot will decline or disappear. One hundred years ago, who could have foreseen the adaptability of species like Red-winged Blackbird, Killdeer, Horned Lark, and Vesper Sparrow to the agricultural landscapes that now dominate in Iowa, or the inability of the Greater Prairie-Chicken to adapt to those same changes? Likewise, habitat changes, in Iowa often dominated by federal agricultural programs, will also help dictate the avifauna of the future. One promising trend is the increasing recognition of the effect those programs have on birds and other wildlife, and the development of programs like the Conservation Reserve Program (CRP) which, if properly implemented, can have multiple benefits including those for wildlife. The CRP is a good example of how such programs can affect bird populations. In the mid 1990s, more than 2 million acres of Iowa was enrolled in the CRP, much of it in some type of grass cover. Recent rule changes in the CRP will reduce that amount, especially in northern Iowa. As a result, most land enrolled in the CRP will be in southern Iowa and presumably grassland bird populations will change accordingly.

To maintain some semblance of our native avifauna, vigilance is needed, but there are some positive signs. In recent years, natural resource managers in Iowa have increasingly been working to restore the most natural habitats possible to land that previously had been highly altered, often for agriculture. The application of science to help us understand how to restore prairies and wetlands to fully functioning biological ecosystems (e.g., Galatowitsch and van der Valk 1994, Packard and Mutel 1997) should help us provide better habitats for birds and other wildlife in the future. Continued scientific study, application of that science to real-world problems, and an informed citizenry are the best weapons we have to try to make sure Iowa continues to have the diverse avifauna it has now.

ACKNOWLEDGMENTS

This article could not have been written without the hundreds of reports by Iowa's birders, scientists, and others, the countless hours put into the Breeding Bird Atlas project by more than 500 volunteers, and the dedicated volunteers who run the Breeding Bird Survey routes each year. Individually, Bruce Ehresman and Mike Griffin of the Iowa Department of Natural Resources provided me access to unpublished reports on several species. Steve Dinsmore was especially helpful in sharing his knowledge of Iowa's birds and in developing the list in Table 2. The comments of two reviewers were very helpful in revising this paper. To all of these individuals, most of them unnamed, I give my sincerest thanks for their contributions. This is Journal Paper J-17563 of the Iowa Agriculture and Home Economics Experiment Station, Ames; Project 3478.

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Appendix A. Scientific names of bird species mentioned in text. Names are taken from the American Ornithologists' Union (1983) and supplements to that publication.

American White Pelican *Pelecanus erythrorhynchos* Gmelin
Double-crested Cormorant *Phalacrocorax auritus* (Lesson)
American Bittern *Botaurus lentiginosus* (Rackett)
Great Blue Heron *Ardea herodias* Linnaeus
Great Egret *Ardea alba* Linnaeus
Little Blue Heron *Egretta caerulea* (Linnaeus)
Cattle Egret *Bubulcus ibis* (Linnaeus)
Black-crowned Night-Heron *Nycticorax nycticorax* (Linnaeus)
Yellow-crowned Night-Heron *Nyctanassa violacea* (Linnaeus)
White-faced Ibis *Plegadis chihi* (Vieillot)
Turkey Vulture *Cathartes aura* (Linnaeus)
Trumpeter Swan *Cygnus buccinator* Richardson
Canada Goose *Branta canadensis* (Linnaeus)
Wood Duck *Aix sponsa* (Linnaeus)
Green-winged Teal *Anas crecca* Linnaeus
Mallard *Anas platyrhynchos* Linnaeus
Northern Pintail *Anas acuta* Linnaeus
Northern Shoveler *Anas clypeata* Linnaeus
Gadwall *Anas strepera* Linnaeus
Redhead *Aythya americana* (Eyton)
Ring-necked Duck *Aythya collaris* (Donovan)
Hooded Merganser *Lophodytes cucullatus* (Linnaeus)
Ruddy Duck *Oxyura jamaicensis* (Gmelin)
Osprey *Pandion haliaetus* (Linnaeus)
Mississippi Kite *Ictinia mississippiensis* (Wilson)
Bald Eagle *Haliaeetus leucocephalus* (Linnaeus)
Northern Harrier *Circus cyaneus* (Linnaeus)
Cooper's Hawk *Accipiter cooperii* (Bonaparte)
Red-shouldered Hawk *Buteo lineatus* (Gmelin)
Broad-winged Hawk *Buteo platypterus* (Vieillot)
Swainson's Hawk *Buteo swainsoni* Bonaparte
Peregrine Falcon *Falco peregrinus* Tunstall
Gray Partridge *Perdix perdix* (Linnaeus)
Ring-necked Pheasant *Phasianus colchicus* Linnaeus
Greater Prairie-Chicken *Tympanuchus cupido* (Linnaeus)
Sharp-tailed Grouse *Tympanuchus phasianellus* (Linnaeus)
Wild Turkey *Meleagris gallopavo* Linnaeus
Northern Bobwhite *Colinus virginianus* (Linnaeus)
King Rail *Rallus elegans* Audubon
Common Moorhen *Gallinula chloropus* (Linnaeus)
American Coot *Fulica americana* Gmelin
Sandhill Crane *Grus canadensis* (Linnaeus)
Piping Plover *Charadrius melodus* Ord
Killdeer *Charadrius vociferus* Linnaeus
Upland Sandpiper *Bartramia longicauda* (Bechstein)
Ring-billed Gull *Larus delawarensis* Ord
Forster's Tern *Sterna forsteri* Nuttall
Least Tern *Sterna antillarum* (Lesson)
Black Tern *Chlidonias niger* (Linnaeus)
Eurasian Collared-Dove *Streptopelia decaocto* (Frivaldszky)
White-winged Dove *Zenaida asiatica* (Linnaeus)
Mourning Dove *Zenaida macroura* (Linnaeus)
Barn Owl *Tyto alba* (Scopoli)
Long-eared Owl *Asio otus* (Linnaeus)
Short-eared Owl *Asio flammeus* (Pontoppidan)
Chuck-will's-widow *Caprimulgus carolinensis* Gmelin
Red-headed Woodpecker *Melanerpes erythrocephalus* (Linnaeus)
Yellow-bellied Sapsucker *Sphyrapicus varius* (Linnaeus)
Northern Flicker *Colaptes auratus* (Linnaeus)
Least Flycatcher *Empidonax minimus* (Baird and Baird)
Say's Phoebe *Sayornis saya* (Bonaparte)
Western Kingbird *Tyrannus verticalis* Say
Eastern Kingbird *Tyrannus tyrannus* (Linnaeus)
Horned Lark *Eremophila alpestris* (Linnaeus)
Cliff Swallow *Petrochelidon pyrrhonota* (Vieillot)
Blue Jay *Cyanocitta cristata* (Linnaeus)
Brown Creeper *Certhia americana* Bonaparte
Carolina Wren *Thryothorus ludovicianus* (Latham)
Bewick's Wren *Thryomanes bewickii* (Audubon)
House Wren *Troglodytes aedon* Vieillot
Veery *Catharus fuscescens* (Stephens)
American Robin *Turdus migratorius* Linnaeus
Northern Mockingbird *Mimus polyglottos* (Linnaeus)
Brown Thrasher *Toxostoma rufum* (Linnaeus)
Loggerhead Shrike *Lanius ludovicianus* Linnaeus
White-eyed Vireo *Vireo griseus* (Boddaert)
Blue-winged Warbler *Vermivora pinus* (Linnaeus)
Northern Parula *Parula americana* (Linnaeus)
Chestnut-sided Warbler *Dendroica pensylvanica* (Linnaeus)
Yellow-throated Warbler *Dendroica dominica* (Linnaeus)
Prairie Warbler *Dendroica discolor* (Vieillot)
Cerulean Warbler *Dendroica cerulea* (Wilson)
Worm-eating Warbler *Helmitheros vermivorus* (Gmelin)
Louisiana Waterthrush *Seiurus motacilla* (Vieillot)
Common Yellowthroat *Geothlypis trichas* (Linnaeus)
Yellow-breasted Chat *Icteria virens* (Linnaeus)
Summer Tanager *Piranga rubra* (Linnaeus)
Northern Cardinal *Cardinalis cardinalis* (Linnaeus)
Dickcissel *Spiza americana* (Gmelin)
Vesper Sparrow *Pooecetes gramineus* (Gmelin)
Henslow's Sparrow *Ammodramus henslowii* (Audubon)
Bobolink *Dolichonyx oryzivorus* (Linnaeus)
Red-winged Blackbird *Agelaius phoeniceus* (Linnaeus)
Great-tailed Grackle *Quiscalus mexicanus* (Gmelin)
House Finch *Carpodacus mexicanus* (Muller)
Red Crossbill *Loxia curvirostra* Linnaeus
American Goldfinch *Carduelis tristis* (Linnaeus)
House Sparrow *Passer domesticus* (Linnaeus)
Eurasian Tree Sparrow *Passer montanus* (Linnaeus)